M777 Lightweight Howitzer

PROBLEM / OBJECTIVE

The M777 program is a joint effort between the U.S. Marine Corps and the U.S. Army to replace aging, steel-intensive M198 155MM Howitzers. The use of high strength titanium alloy Ti-6Al-4V for a major portion of the M777 reduces the total weight from over 16,000 pounds to 9,000 pounds, a 45% weight reduction.

Titanium product forms are generally several times more expensive than steel. Moreover, associated manufacturing practices (casting, forging, extrusion, rolling, machining and welding) for titanium are substantially more expensive relative to steel. Thus, the NCEMT program has developed and implemented novel manufacturing approaches to reduce the part count for various M777 components and implemented novel forming technologies that reduce manufacturing cost and material waste.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The three major components targeted by NCEMT for process improvements and their accompanying function in the M777 Lightweight Howitzer are listed below.

- Spade – Prevents rearward motion of the howitzer during firing.
- Saddle – Connects the gun cradle and elevating mass to the lower carriage of the howitzer.
- Cradle Tubes – Provides structural support to the cannon assembly and recoil system.

The NCEMT program developed the following improvements:

- The initial spade was comprised of 60 parts that were welded together and stress relieved. The NCEMT Program has replaced this costly, labor-intensive approach with a single-piece casting.
- The Saddle was reduced from 110 parts to a three-piece casting in an earlier iteration. The NCEMT is converting the three-piece casting to a one-piece casting to reduce distortion and delivery time, thereby decreasing cost.
- Cradle tubes used during the manufacturing design stage were comprised of hot worked and machined tube. The NCEMT is developing novel cold-working technologies, such as flowforming, to reduce manufacturing waste.

The spade of the M777 Lightweight Howitzer.

Implementation and Technology Transfer:

Four cast spades were delivered in October 2003 and have been subjected to test firing. The cast spades are now implemented into the Low Rate Production phase of the program. Flowformed Ti-6Al-4V tube was delivered in December 2003; this technology will be implemented after mechanical testing, dimensional tolerance evaluations and test firings. The initial single-piece saddle will be cast in the first quarter of 2004. Both the cradle tubes and saddle will be implemented into Full Rate Production in October 2004.

Expected Benefits:

The process improvements developed by the NCEMT are expected to save $46 million over Full Rate Production based on production of 650 units.

TIME LINE / MILESTONE

Start Date: August 2002
End Date: September 2005

FUNDING

Navy ManTech Project Number C1025: $4.1M
Cost Sharing: $497K (BAE, JPMO, PCC)

PARTICIPANTS

National Center for Excellence in Metalworking Technology
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Joint Program Management Office (JPMO)
PCC Structurals
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